

DrägerService®

Dräger

Field Service Procedure

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NM MRI VPO Upgrade

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NM MRI VPO Upgrade

Upgrade Procedure

General Warnings and Cautions that apply to this Service Procedure:

- WARNING:** Any person involved with the setup, operation, or maintenance of the Narkomed MRI anesthesia system must be thoroughly familiar with the instruction manual for this product.
- WARNING:** Do not place any object on this machine unless it is specifically labeled to be used in an MRI scanning room and on the Narkomed MRI anesthesia system. Objects placed on this machine that are not designed for use with this anesthesia system may be strongly attracted to the magnet and may cause serious injury or death when the machine is used in an MRI scanning room.
- WARNING:** Always lock the casters after this anesthesia machine has been positioned in the MRI scanner room. Magnetic attractive forces between the magnet and the anesthesia machine may cause unintentional movement of the anesthesia machine if the casters are unlocked.
- WARNING:** The anesthesia machine must be removed from the MRI scanner room before servicing the machine. Do not enter the MRI scanner room with any tools or instruments. These items may be strongly attracted to the magnet and may cause serious injury or death when brought into an MRI scanning room.
- WARNING:** Do not bring any ferromagnetic tools or equipment into the scanning room. Ferromagnetic objects (made of steel, iron, or stainless steel) are strongly attracted to the magnet and can become harmful projectiles.
- WARNING:** Use only nonmagnetic (aluminum) E-cylinders with this machine. Steel cylinders can cause serious injury or death if brought into an MRI scanning room.
- CAUTION:** When moving the machine, be sure to set the absorber to its lowest position on the absorber pole. To avoid personal injury or damage to the unit, do not use the absorber pole to push or pull the machine. It is recommended that two people move the machine to aid in maneuverability on inclines, around corners, and over raised thresholds.

Upgrade Procedure (continued)

Overview:

This procedure outlines the steps needed to upgrade a Narkomed MRI having a Core-M monitor, and replace it with a VPO monitor. Several assemblies on the machine must be replaced along with their associated cables, according to the following schedule:

- Remove the Core-M monitor
- Remove the bellows assembly
- Remove the battery box assembly
- Remove the vent box chassis and AV2+ bezel assembly
- Remove the alarm channel, install a new PCB and reinstall the alarm channel
- Install a new vent box chassis with AV2+ bezel assembly
- Reinstall the bellows assembly
- Install the VPO monitor
- Install a new battery box assembly
- Install an ultrasonic flow sensor on the absorber
- Install a new power supply - if applicable

NOTE: Part numbers shown in this procedure reflect new parts that are provided in the upgrade kit.

NOTE: The shipping container is designed for reuse to return parts removed to DrägerService. An airway bill is also supplied for return of the goods. Care shall be exercised when unpacking this container to maintain its protective integrity for reuse.

Upgrade Procedure (continued)

General Machine Preparation:

1. Drain all pipeline and cylinder gases.
2. Turn the System Power switch to STANDBY and remove the power cord from the rear of the machine.
3. Disconnect the O₂ sensor from the rear of the Core-M monitor.
4. Remove the battery box cover.
5. Disconnect the battery cable from J2 on the battery box PCB. See Figure 1.
6. Remove the ventilator cover screws and install them in the new vent box chassis.
7. Remove the ventilator box top cover.
8. Remove the flowmeter housing rear cover.
9. Loosen the table top screws and remove the table top.
10. At the rear of the bellows box, remove the screws holding the grille cover, and loosen the two bottom screws. Carefully remove the bellows rear grille cover. See Figure 2.

Note the positioning of the foam silencing material for later re-assembly.
11. Remove the frame leg corner access cover.

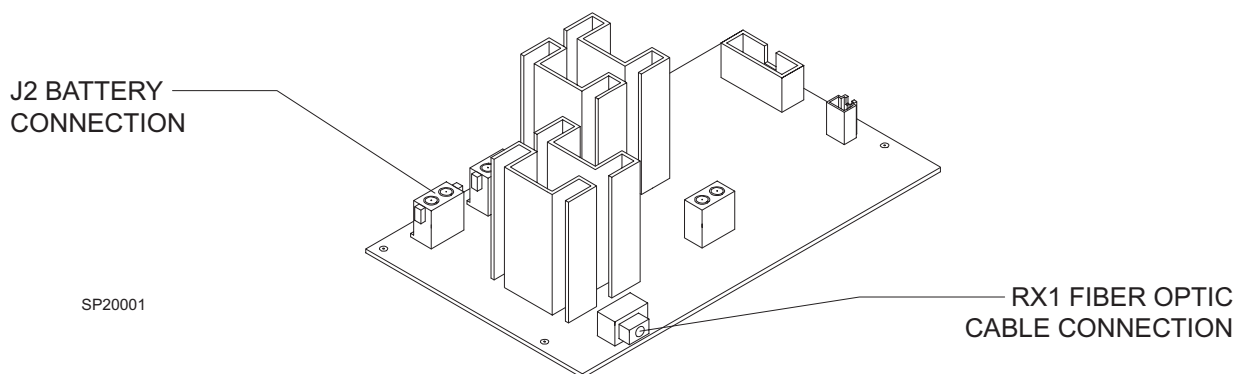


FIGURE 1. Battery Box PCB

Upgrade Procedure (continued)

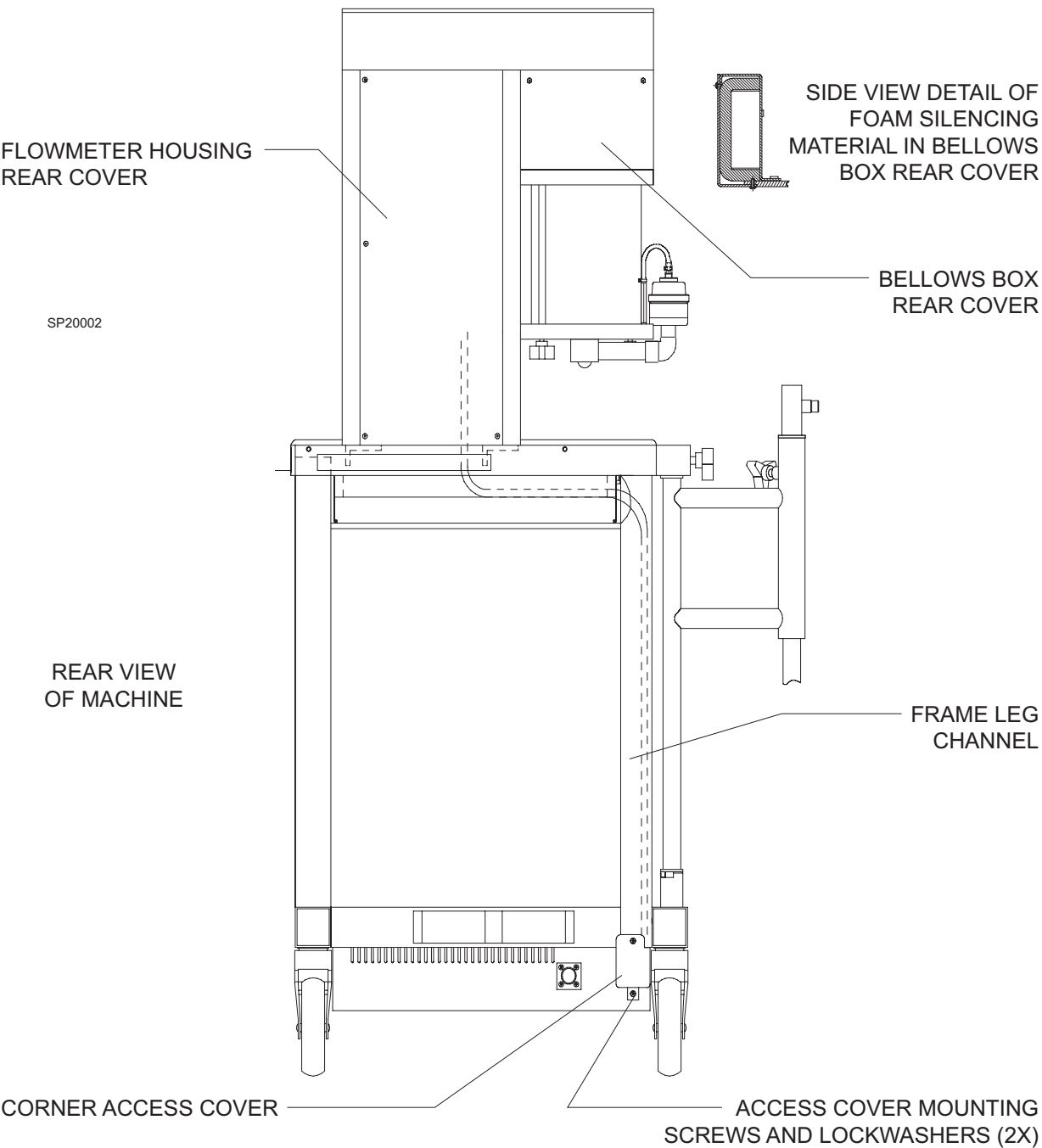


FIGURE 2. Location of Access Covers

Upgrade Procedure (continued)

Core-M Monitor Removal:

12. Disconnect the 9V supply cable from the rear of the Core-M monitor. See Figure 3.
13. Disconnect the tri-lumen tubing from the back of the Core-M monitor, and remove the flow sensor from the absorber system.
14. While supporting the Core-M monitor, remove the screws securing the monitor to the ventilator box and remove the monitor.

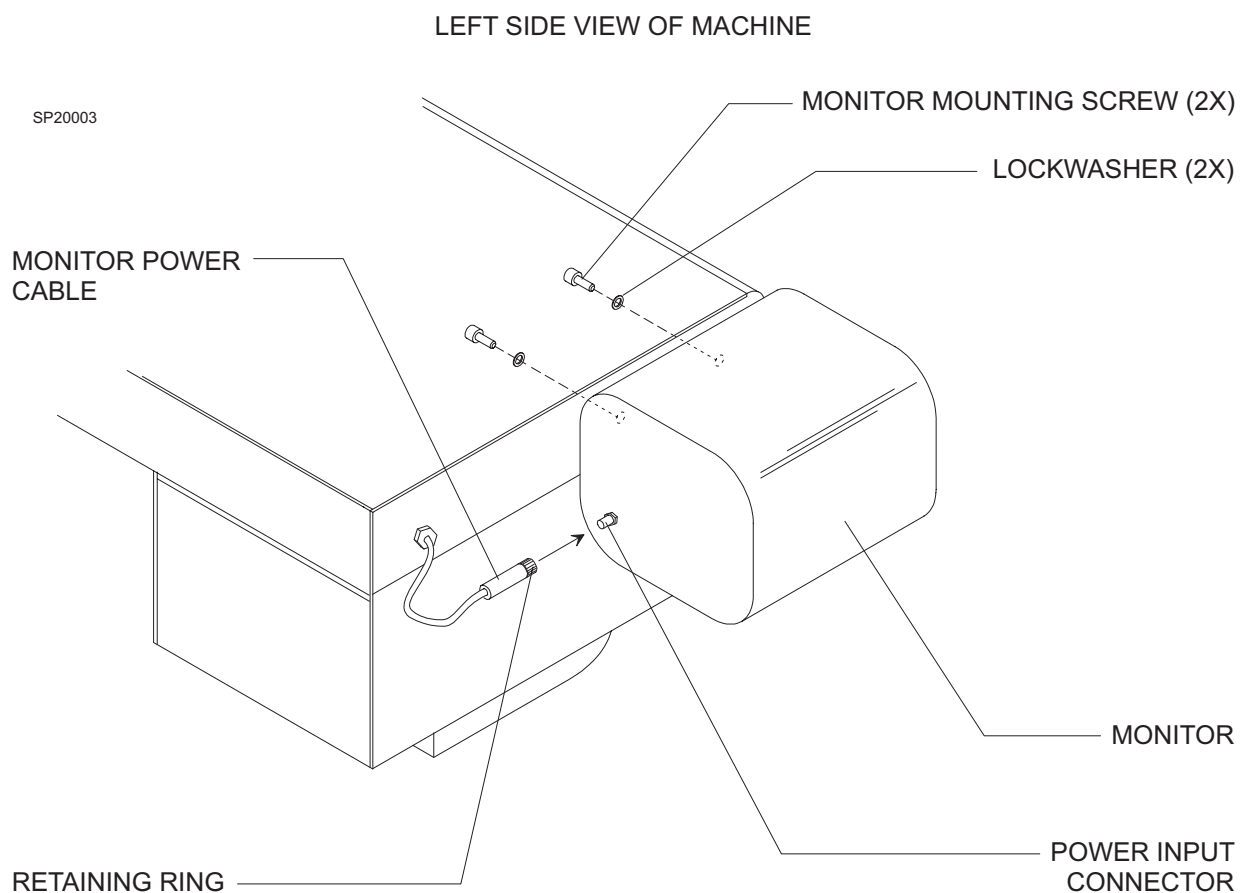


FIGURE 3. Core-M Monitor Removal

Upgrade Procedure (continued)

AV2+ Bezel Assembly Disconnects:

- | | |
|---|---|
| <p>15. Disconnect the large and small diameter pneumatic tubing at locations A, B, C, D, and E as shown in Figure 4.</p> <p>16. Disconnect the red and white wires from the feed-thru filters on the rear bulkhead of the shield box. Note the arrangement of these wires so they can be connected to the replacement assembly in the same manner.</p> <p>17. Disconnect the black ground wire from the stud on the shield box bulkhead.</p> | <p>18. Disconnect the fiber optic cable from RX1 on the battery box PCB. See Figure 1.</p> <p>19. Feed the fiber optic cable up from the battery box to the AV2+ controller. Carefully coil the fiber optic cable and secure it to the AV2+ controller.</p> |
|---|---|

NOTE: If the ground wire is not connected to the stud but is clamped under the aluminum block (see dotted line in the illustration), pull the ground wire out, straighten it, and install a ring terminal (P/N 4110631-001) on the wire.

Upgrade Procedure (continued)

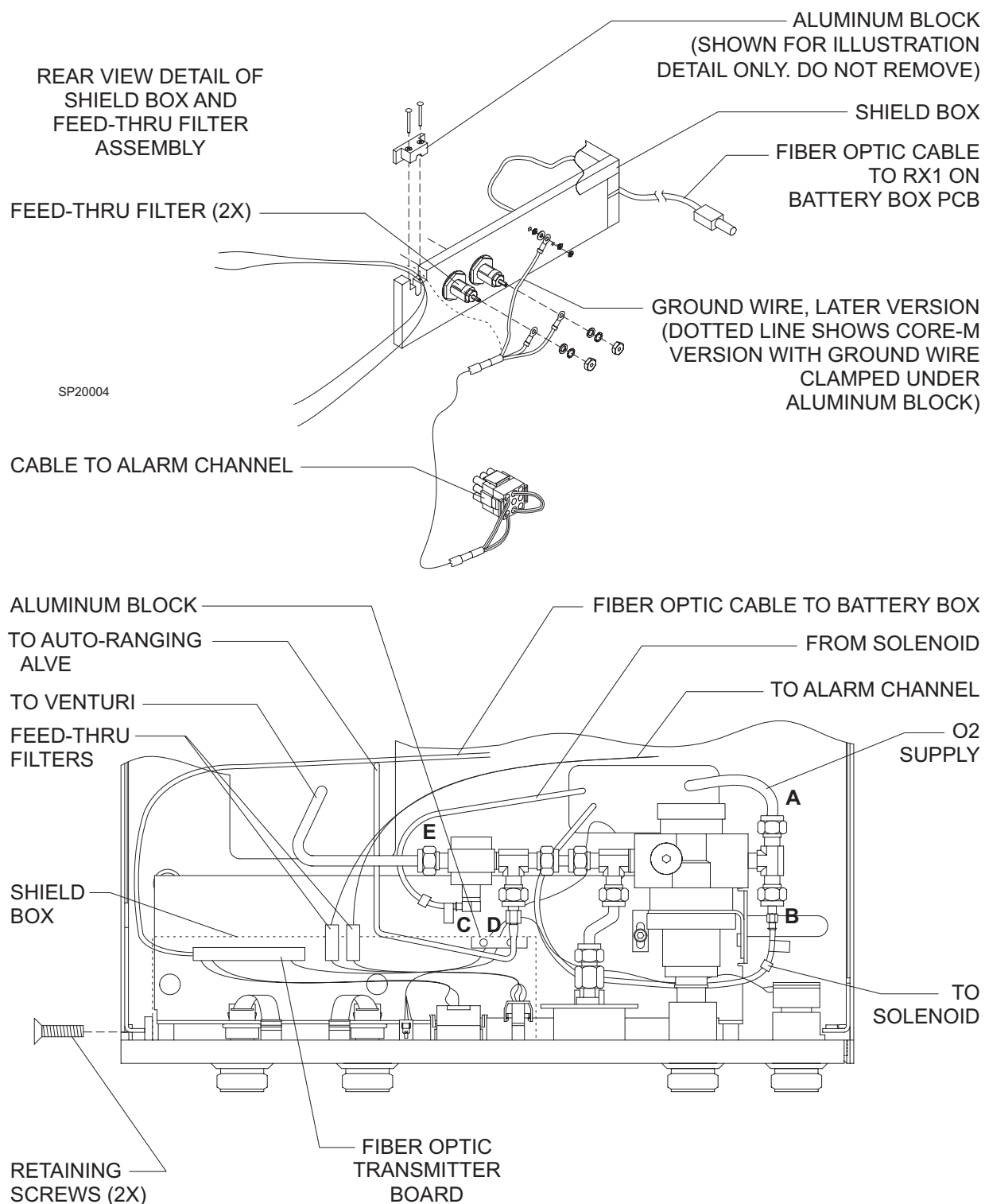


FIGURE 4. AV2+ (MRI) Bezel Assembly Connections (Core-M)

Upgrade Procedure (continued)

Vent Bellows Housing:

20. Remove the cover cap from the inspiratory pressure limit control knob. Loosen the hex nut approximately one turn and remove the knob assembly. See Figure 5.
21. Remove the screws securing the inspiratory control cover plate to the bellows housing, and remove the cover plate.
22. Remove the screws from the angle plate located above the flowmeters.
23. While supporting the complete bellows assembly, remove the screws (two in front, one in rear) that secure it to the ventilator box, and carefully remove the complete bellows assembly.

Cable Removal:

24. Disconnect the ribbon cable from J4 on the alarm channel PCB. See Figure 6.
25. Carefully disconnect the ground wire attached to the ribbon cable.
26. Cut the Core-M monitor 9V cable located inside the vent housing - close to the strain relief.
27. Cut any tie straps securing the 9V cable inside the flowmeter housing.
28. Carefully feed the 9V power cable and the shielded ribbon cable from the vent box down to the frame leg, then from the top of the frame leg to the battery box compartment.

Battery Box Removal:

29. Cut the two 1/8 in. flex tubes marked A&B close to the solenoid hose barbs in the battery box assembly. See Figure 7.

NOTE: The two 1/8 in. flex tubes between the AV2+ and the battery box will remain in the machine.

30. While supporting the bottom of the battery box and carefully remove the four hex bolts securing the battery box to the frame rails, and remove the battery box. See Figure 7.

Vent Box Removal:

31. Remove the screws that secure the vent box to the top of the flowmeter housing and remove the vent box with the AV2+ bezel.

Alarm Channel - New PCB Installation:

32. Cut the cable tie that secures the 1/8 in. tubing to the Clippard valve (for the Aux. O2 flow meter) and remove the tubing. See Figure 6.
33. Disconnect the two ¼ in. copper tubes from the T-fitting on the Clippard valve.
34. Disconnect the ¼ in. copper tube that connects to the fitting on the O2 supply pressure switch.
35. While supporting the alarm channel, remove the upper and lower screws that secure the alarm channel to the flow meter housing, and carefully move the alarm channel slightly outward.

Upgrade Procedure (continued)

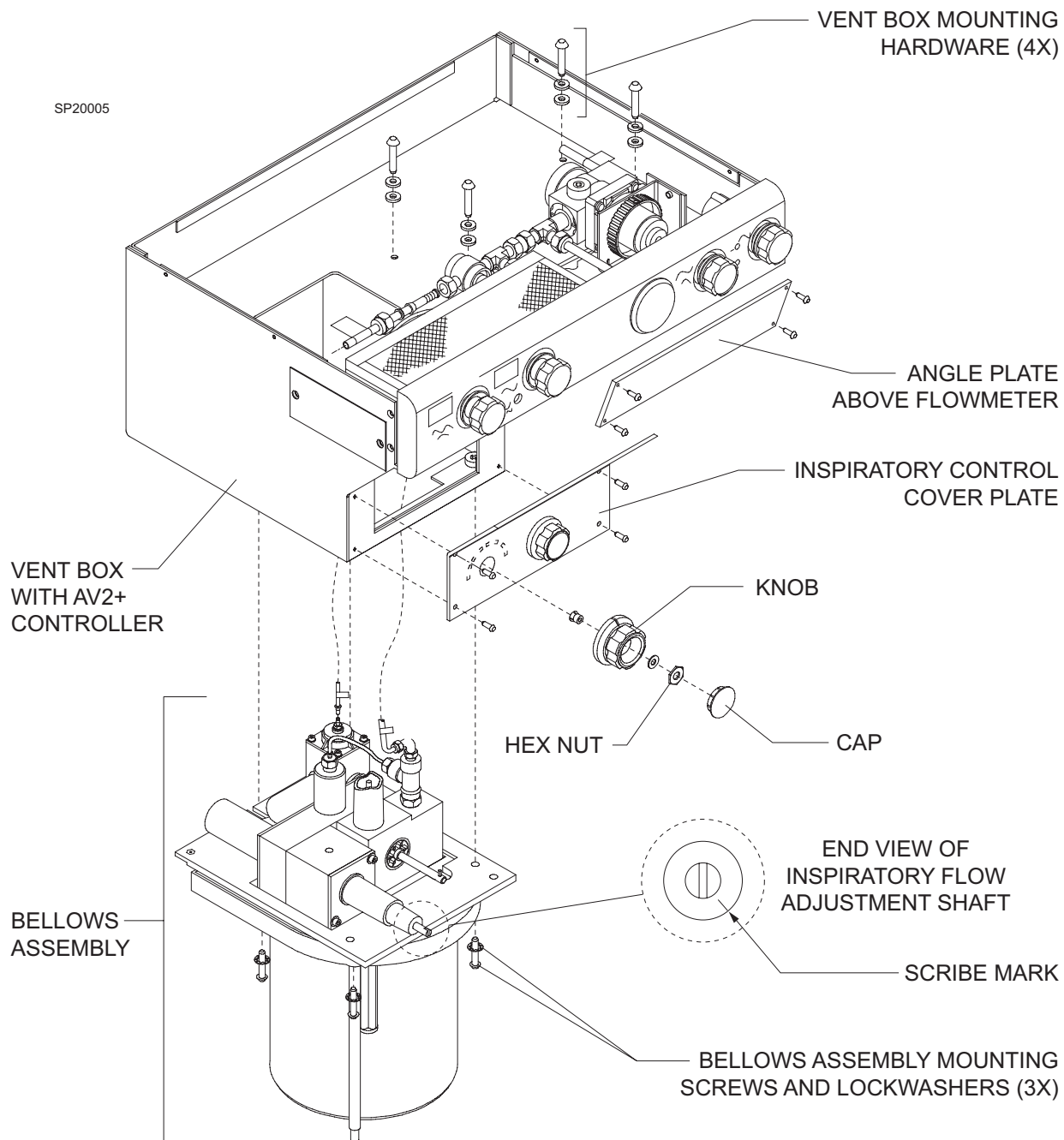


FIGURE 5. Bellows Assembly and Vent Box Removal

Upgrade Procedure (continued)

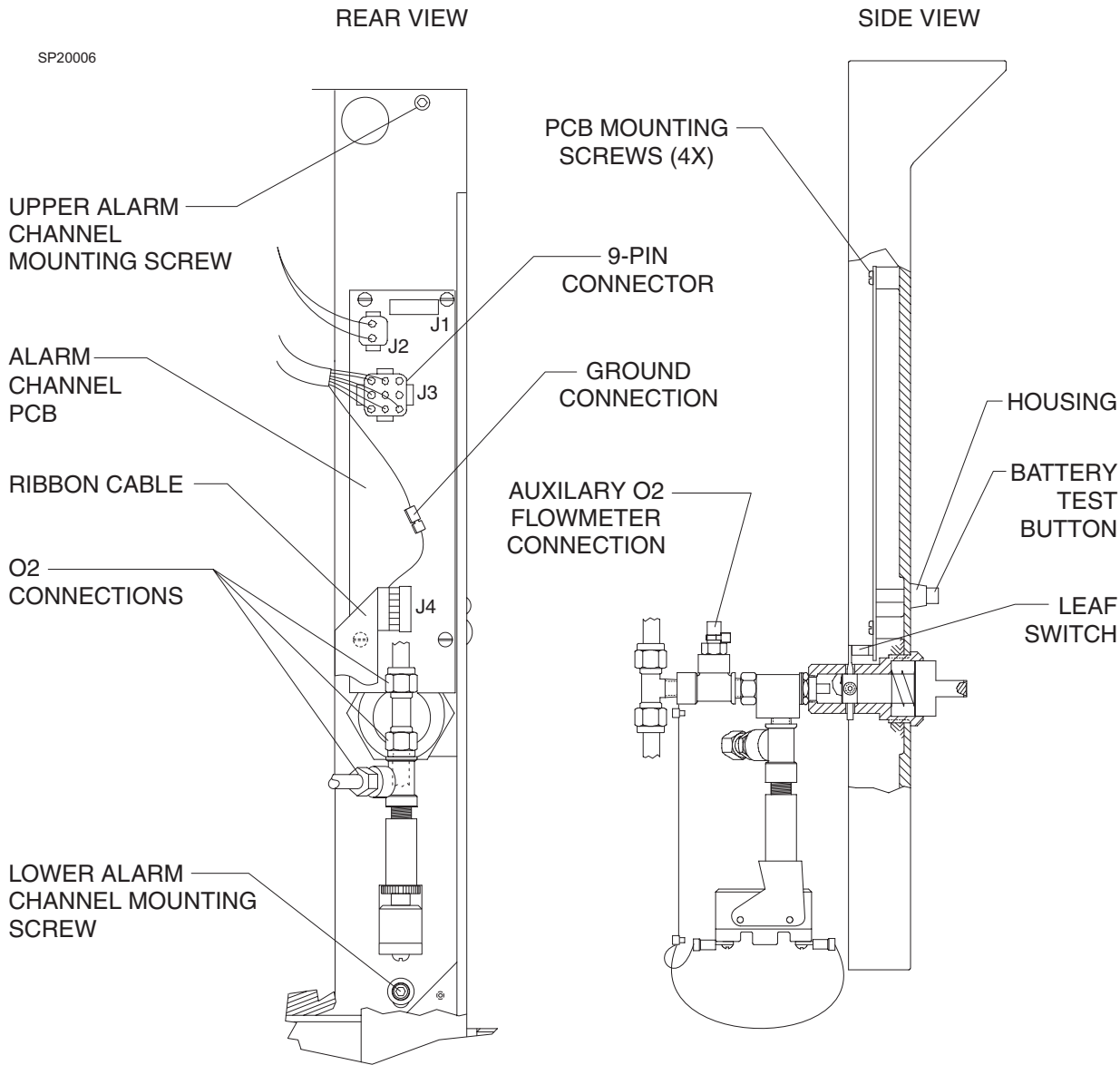


FIGURE 6. Alarm Channel Connections (Core-M)

Upgrade Procedure (continued)

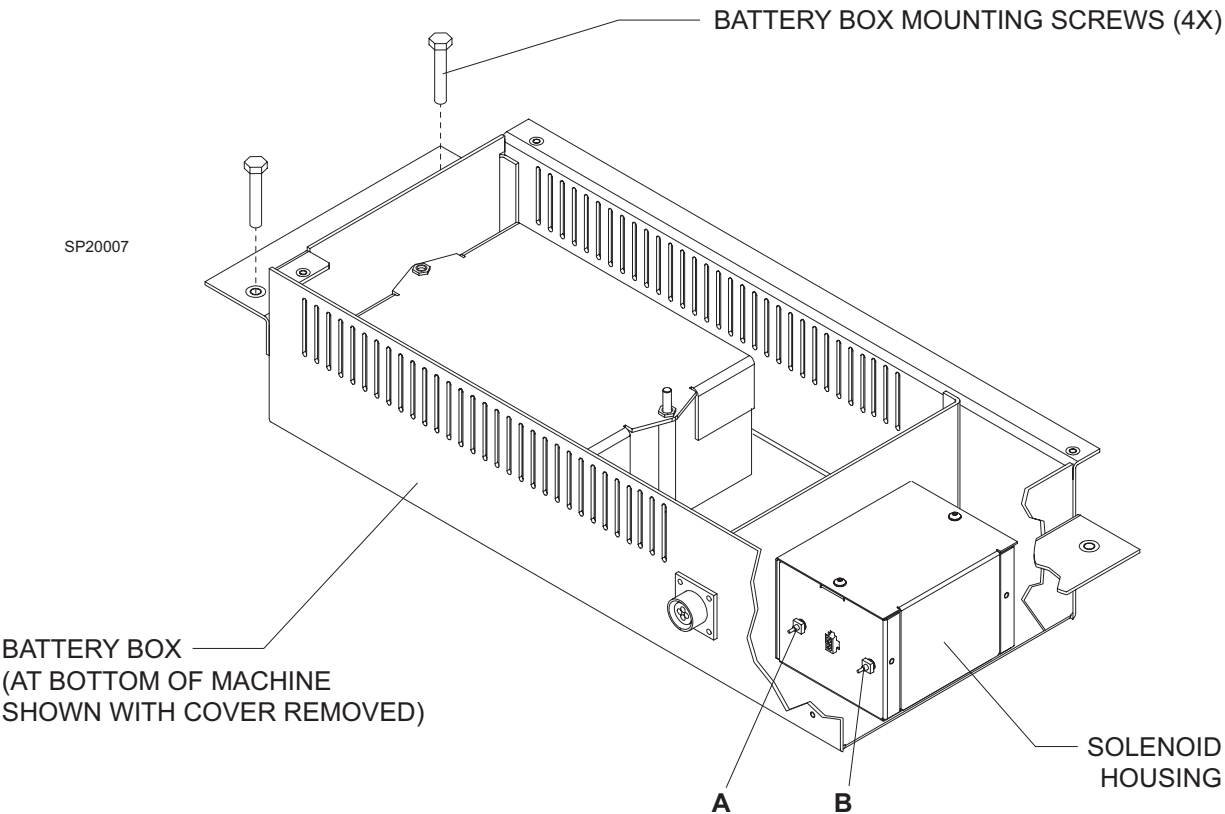


FIGURE 7. Solenoid Tubing Connections

Upgrade Procedure (continued)

CAUTION: the alarm channel circuit board contains static sensitive devices. Use ESD protection when handling the alarm channel PCB.

- | | |
|---|---|
| <p>36. Disconnect the 2-pin connector from J2 on the PCB and feed it through the top hole in the alarm channel.</p> <p>37. Disconnect the 9-pin connector from J3 on the PCB.</p> <p>38. Unscrew the battery test button and housing from the front of the alarm channel, and remove it.</p> <p>39. Turn the system power switch to the ON position and lay the alarm channel down so that the PCB is facing upward.</p> <p>40. Remove the four screws securing the PCB to the channel.</p> <p>41. Install the new PCB (P/N 4116588) in the alarm channel using the original hardware. Reinstall the battery test button and housing on the switch.</p> <p>42. Verify that the leaf switch on the PCB operates correctly. A “clicking” sound should be heard when the system power switch is activated.</p> | <p>43. Place the system power switch in the STANDBY position.</p> <p>44. Locate the black ground wire from the 9-pin connector, and cut off the male quick connect close to the connector.</p> <p>45. Strip the insulation back approx. 1/8 in. and crimp a female quick connector (P/N 4111760) on the ground wire. Make sure the wire is secure.</p> <p>46. Position the alarm channel in front of the flowmeter housing and connect the 9-pin connector to J3 on the alarm channel PCB.</p> <p>47. Feed the 2-pin connector through the hole at the top of the alarm channel and attach the connector to J2 on the alarm channel PCB.</p> <p>48. Reinstall the alarm channel on the flowmeter housing using the original hardware. Do not tighten the screws at this time.</p> <p>49. Reconnect the three ¼ in. copper tubes to their fittings.</p> <p>50. Reconnect the 1/8 in. flex tube to the hose barb, and secure the connection with a small cable tie (P/N 4106068).</p> |
|---|---|

Upgrade Procedure (continued)

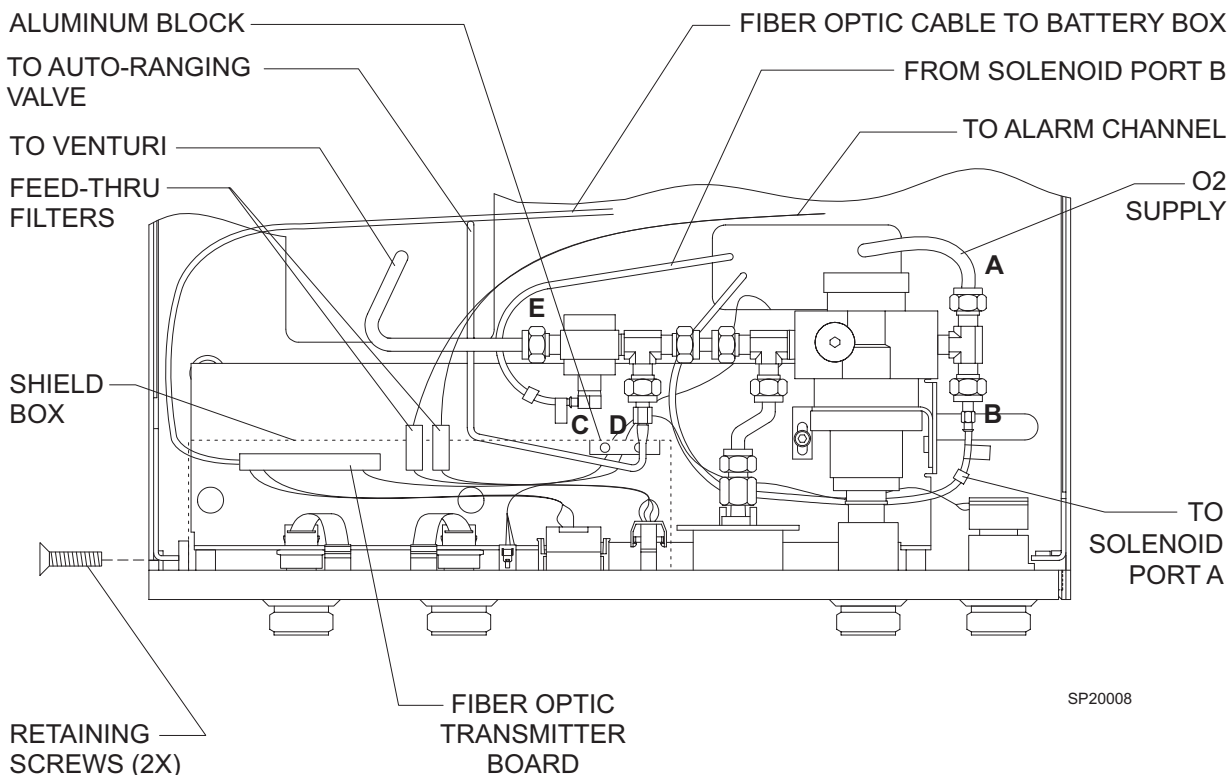
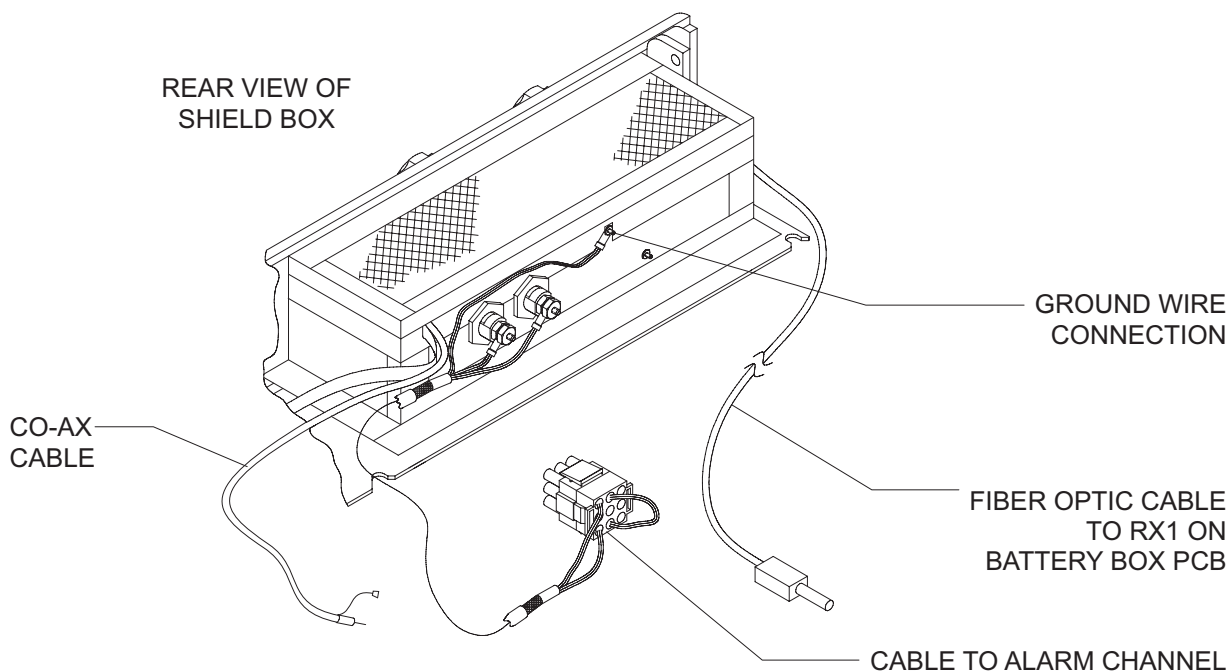
New Vent Box with AV2+ Bezel Assembly Installation:

- | | |
|--|--|
| <p>51. Install the new vent box and AV2+ Bezel assembly on the flowmeter housing and secure it with the original hardware. See Figure 5.</p> <p>52. Support the alarm channel up to the ventilator housing and tighten the two screws securing the alarm channel.</p> <p>53. Carefully reinstall the bellows housing assembly using the original hardware. Ensure that the exhaust port at the rear of the bellows assembly is through the port hole in the ventilator housing.</p> <p>54. Carefully position the foam silencing material in the vent grille rear cover and reinstall it using the original hardware. See Figure 2.</p> <p>55. Align the tidal volume adjustment knob on the angle plate with the roll pin on the bellows assembly. Ensure that the PUSH TO TURN knob works properly, and secure the tidal volume adjustment angle plate using the original hardware.</p> <p>56. Set the inspiratory flow adjustment shaft so that the scribe mark on the shaft housing is pointing at "30" cmH₂O.</p> <p>57. Install the inspiratory flow knob assembly onto the shaft and position it with the white indicator at "30". Tighten the hex nut in the center of the knob, and reinstall the cover cap on the knob.</p> | <p>58. Reinstall the angle plate over the flowmeters with the foam strip against the top of the flow shield.</p> <p>59. Carefully feed the fiber optic cable from the bezel assembly down through the flowmeter housing and continue through the hollow frame leg channel. Be careful not to kink the fiber optic cable.</p> <p style="padding-left: 20px;">Continue to feed the fiber optic cable down the frame leg channel and pull the slack out of the bottom of the frame leg.</p> <p>60. Reconnect the ¼ in. flex tubing from the bellows assembly to point E on the ventilator controller as shown in Figure 8.</p> <p>61. Reconnect the ¼ in. flex tubing from the flowmeter housing to point A on the ventilator controller as shown in Figure 8.</p> <p>62. Reconnect the 1/8 in. flex tubing from the bellows assembly to point D as shown in Figure 8. Secure the connection with the press-on hose clamp.</p> <p>63. Reconnect the 1/8 in. flex tubing marked "A" to point B as shown in Figure 8.</p> <p>64. Reconnect the 1/8 in. flex tubing marked "B" to point C as shown in Figure 8.</p> <p>65. Feed the wire harness from the 9-pin connector on the alarm channel up into the ventilator area.</p> |
|--|--|

Upgrade Procedure (continued)

66. At the rear of the shield box on the AV2+ controller, connect the white wire from the alarm channel wire harness to the right hand feed-thru filter. Connect the red wire to the left hand feed-thru filter. Secure each connection with the previously removed flat washer and hex nut.
67. From the same wire harness, connect the black ground wire to the ground stud on the rear of the AV2+ shield box. Use a #4 kep nut (P/N HW55000).
68. Feed the co-ax cable from the AV2+ shield box down through the top of the flow meter housing.
69. Install the pin at the end of the co-ax cable into Position 1 on the 9-pin connector at J3 on the alarm channel (Position 1 is the only open corner position). Ensure that the pin clicks into position and is secure in the connector. See Figure 12.

Upgrade Procedure (continued)



SP20008

FIGURE 8. AV2+ (MRI) Bezel Assembly Connections (VPO)

Upgrade Procedure (continued)

VPO Monitor Installation:

70. Hold the VPO monitor (P/N 4116091) facing forward, at the left side of the vent box, and feed the cables from the monitor through the large hole in the side of the ventilator housing. See Figure 9.
71. Insert the monitor studs through the holes in the ventilator housing, and install a ¼-20 kep nut (P/N HW55004) on each stud.

Align the monitor flush with the front of the AV2+ bezel front and tighten the two kep nuts.

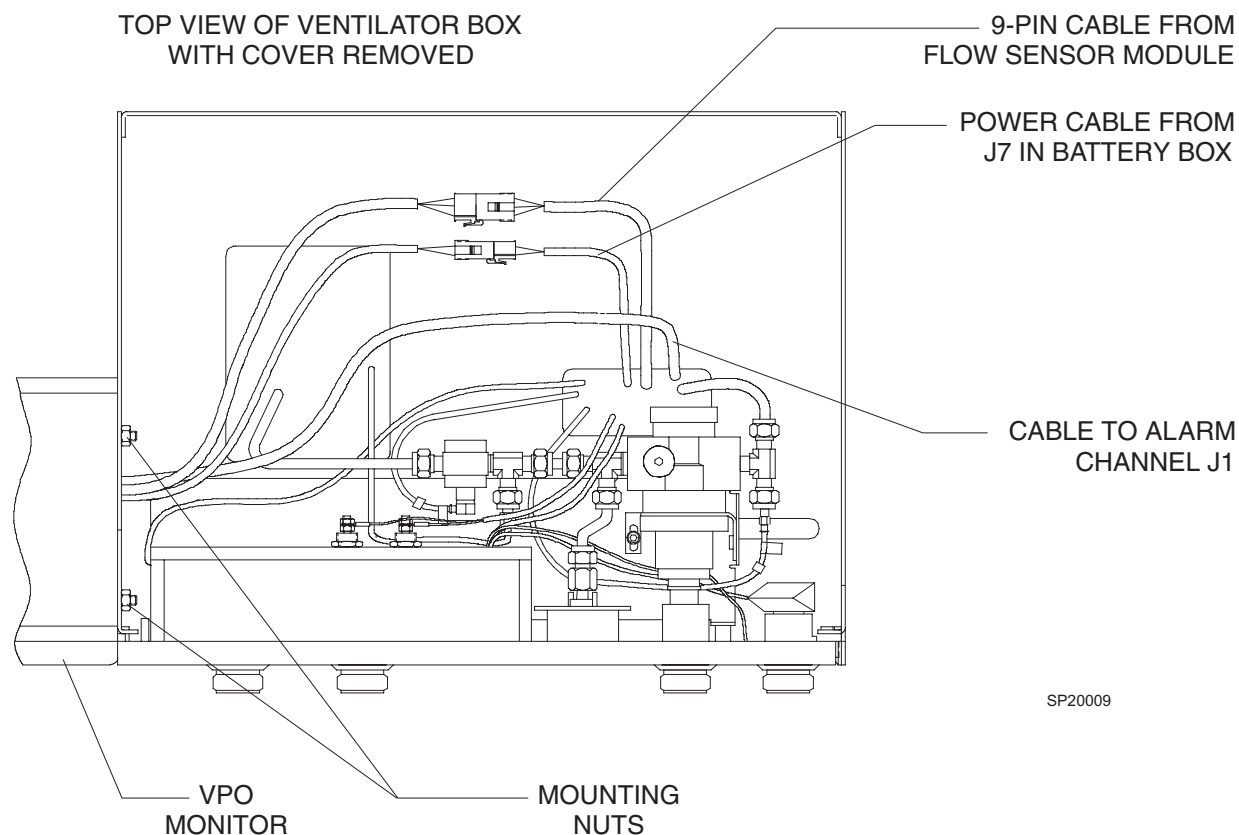


FIGURE 9. VPO Monitor Installation

Upgrade Procedure (continued)

New Battery Box Installation:

NOTE: The battery box is shipped with its cover attached. The cover must be removed in order to install the battery box on the machine.

CAUTION: Be careful not to damage the flow sensor and cable assembly that is permanently attached to the battery box.

- | | |
|--|--|
| <p>72. Remove the battery box cover - carefully remove the flow sensor cable strain relief bushing from its slot in the cover (ref. Figure 13).</p> <p>73. Position the new battery box assembly (P/N 4116235) under the frame rails of the machine, with the solenoid box toward the left side of the machine.</p> <p>74. Place a support under the battery box, and secure it to the frame rails with the hardware previously removed.</p> | <p>75. Connect the shielded 14-pin ribbon cable (P/N 4116392) end with the ring connector, to J3 on the battery box PCB. See Figure 10.</p> <p>76. Connect the VPO monitor 4-pin power cable (P/N 4116313) to J7 on the battery box PCB.</p> <p>77. Install an ext-t lock washer (P/N HW68001) on the open ground stud in the battery box, and install the shielded ribbon cable ground wire on the stud.</p> <p>78. Install another ext-t lock washer (P/N HW68001) on the ground stud, then install the monitor power cable ground wire. Secure the ground connections with a #8 kep nut (P/N HW55001).</p> <p>79. Open the cable hold-down clip in the battery box. Route the shielded ribbon cable, the flow sensor cable and the monitor power cable through the clip, and re-close the clip.</p> |
|--|--|

Upgrade Procedure (continued)

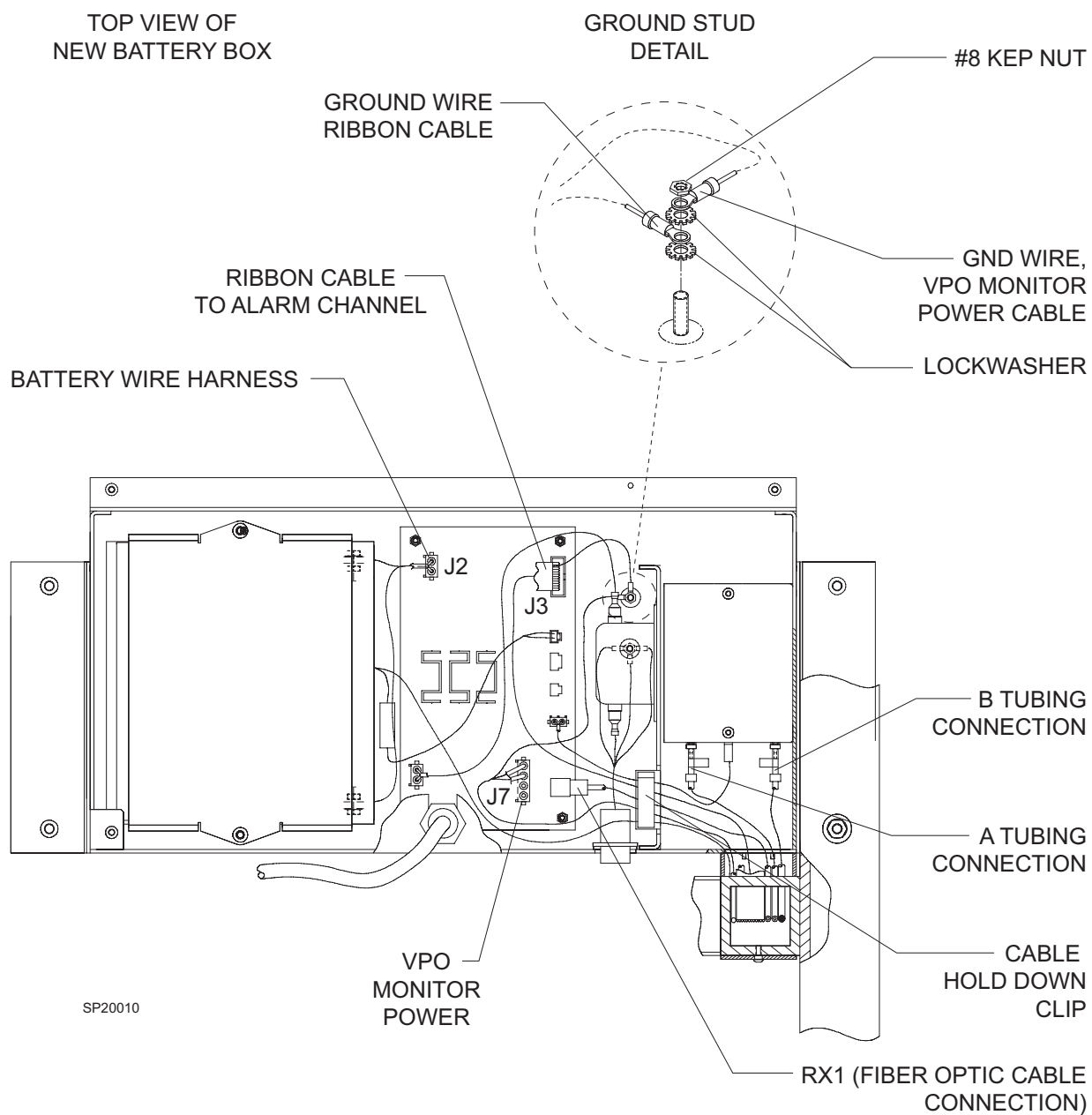


FIGURE 10. New Battery Box Connections

Upgrade Procedure (continued)

Cable Routing:

80. Route the cables from the battery box out through the corner access hole at the rear of the battery box and straighten the cables out on the floor. See Figure 11.

Hold the cable bundle up against the outside of the frame leg channel, and tape the cables together just above table top level.
81. Feed the complete cable bundle up inside the bottom of the frame leg and carefully pull the excess upward.
82. Remove the tape and work each cable up through the round hole in the frame leg. Ensure that all cables are pulled through the top of the frame leg.
83. Work all cables under the N2O regulator and continue into the bottom of the flowmeter housing, then upward into the flowmeter housing.
84. Connect the shielded ribbon cable to J4 on the alarm channel PCB. See Figure 12.
85. Feed the remaining cables up through the flowmeter housing into the ventilator chassis area.
86. Join the 4-pin male connector on the VPO power cable to the 4-pin female connector from the VPO monitor. See Figure 9.
87. Join the 9-pin connector on the flow sensor cable to the 9-pin connector from the VPO monitor.
88. In the flowmeter housing, feed the remaining 16-pin ribbon cable from the VPO monitor down through the flowmeter housing, and connect the cable to J1 on the alarm channel PCB.
89. At the back of the alarm channel, join the four cable grounds as shown in the floating ground detail in Figure 12, using the double adapter (P/N 4107069) and two double male adapters (P/N 4116404).
90. Install the rubber cap (P/N 4116405) over the floating grounds as shown in the illustration.
91. At the bottom of the frame leg, feed the fiber optic cable into the battery box.
92. Un-clip the cable hold-down and position the fiber optic cable in the hold-down. Connect the cable to RX1 on the PCB and re-clip the cable hold-down.
93. Feed the two 1/8 in. flex tubes marked A & B into the battery box through the access hole at the rear corner. See Figure 10.
94. Connect these tubes to the corresponding hose barbs marked A & B on the solenoid box.
95. Reinstall the frame leg corner access cover with the hardware that was previously removed.
96. Connect the battery wire harness to J2 on the battery box PCB.

Upgrade Procedure (continued)

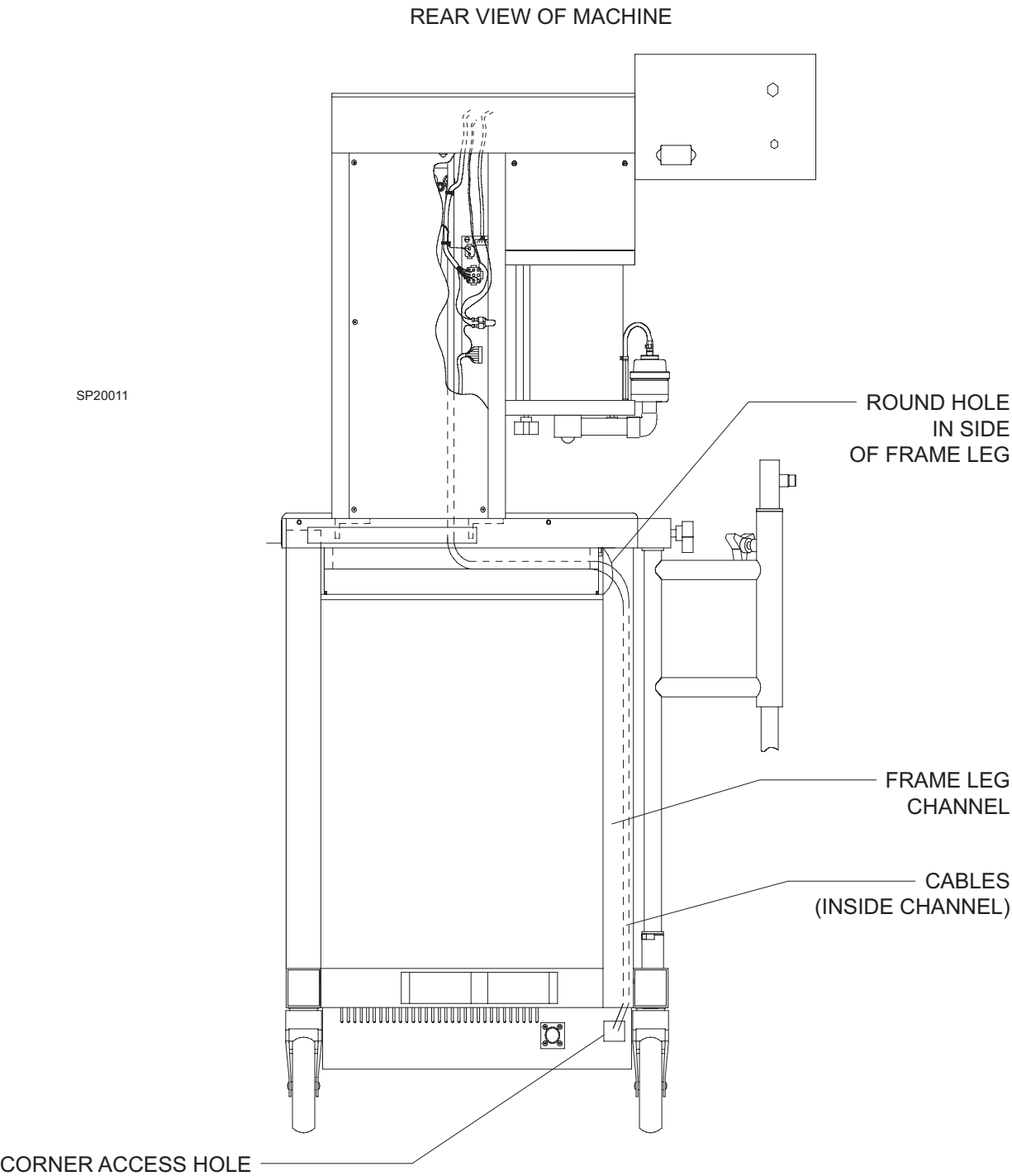


FIGURE 11. Cable Routing Arrangement

Upgrade Procedure (continued)

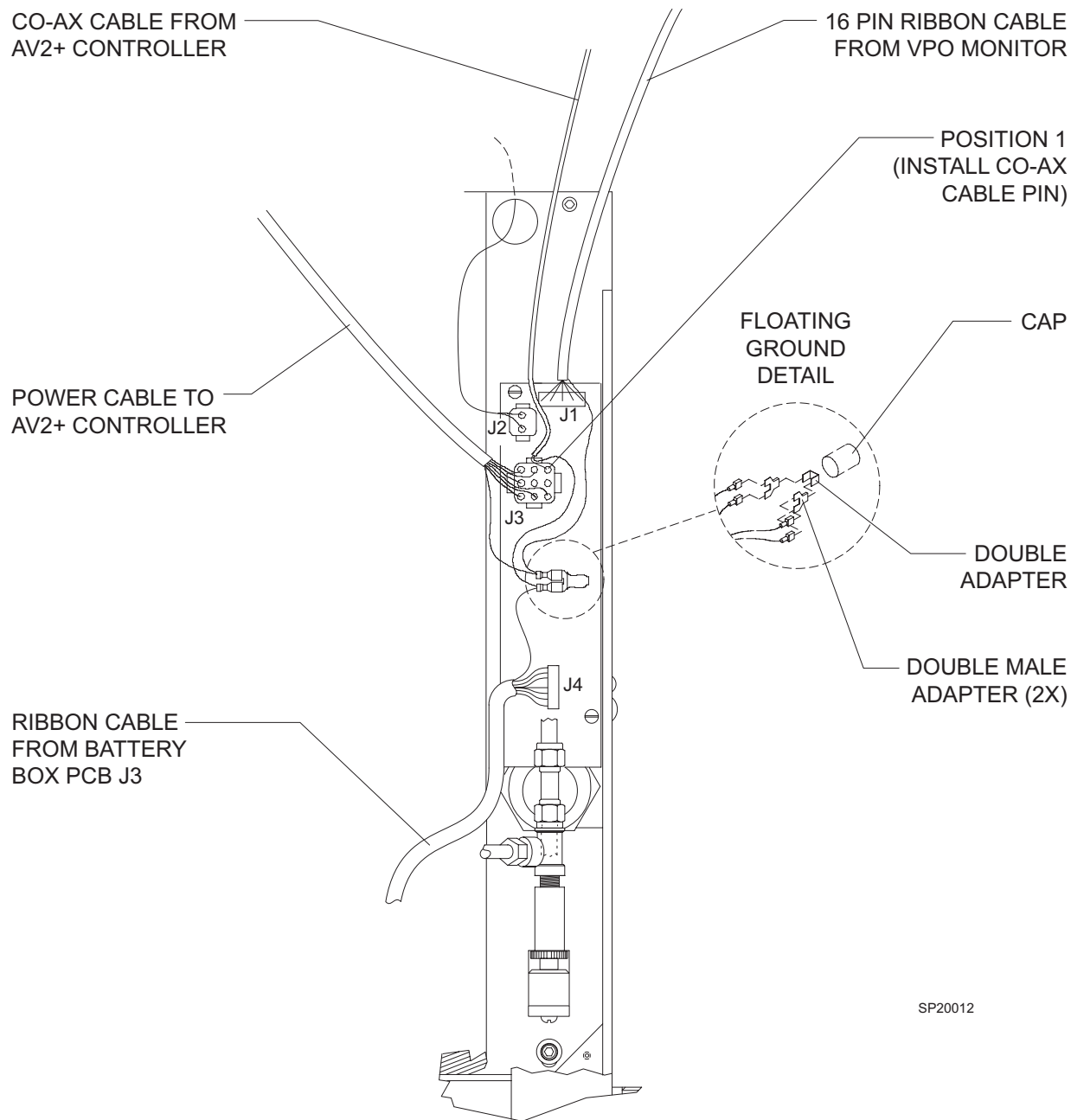


FIGURE 12. New Alarm Channel Connections

Upgrade Procedure (continued)

97. Position the new battery box cover (P/N 4116247) with its lip downward at the front of the machine, and its slot at the rear. See Figure 13.
98. Install the strain relief bushing with the flow sensor cable - into the slot in the battery box cover at a position on the cable that will allow the cover to be easily removed. Tighten the strain relief bushing onto the cable.
99. Install the battery box cover with the hardware that was previously removed.

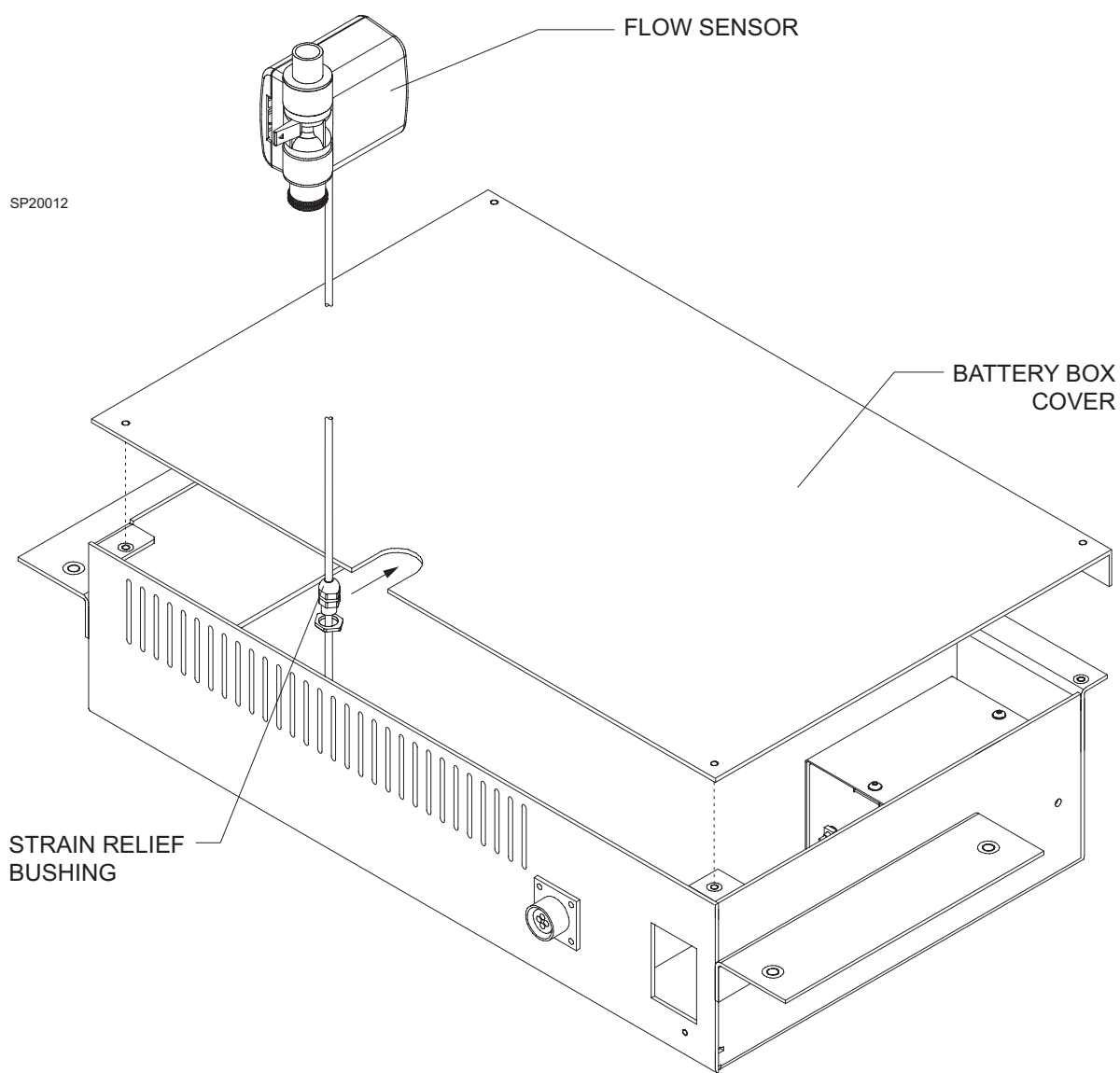


FIGURE 13. Flow Sensor Cable Install

Upgrade Procedure (continued)

100. On the bottom of the table top, remove the four screws holding the pullout checklist cover plate. See Figure 14.
101. Remove the existing pullout checklist and replace it with the new one (P/N 4114367).
102. Reinstall the bottom cover plate (ensure that the guide pin is in the checklist slot) with the hardware that was previously removed.

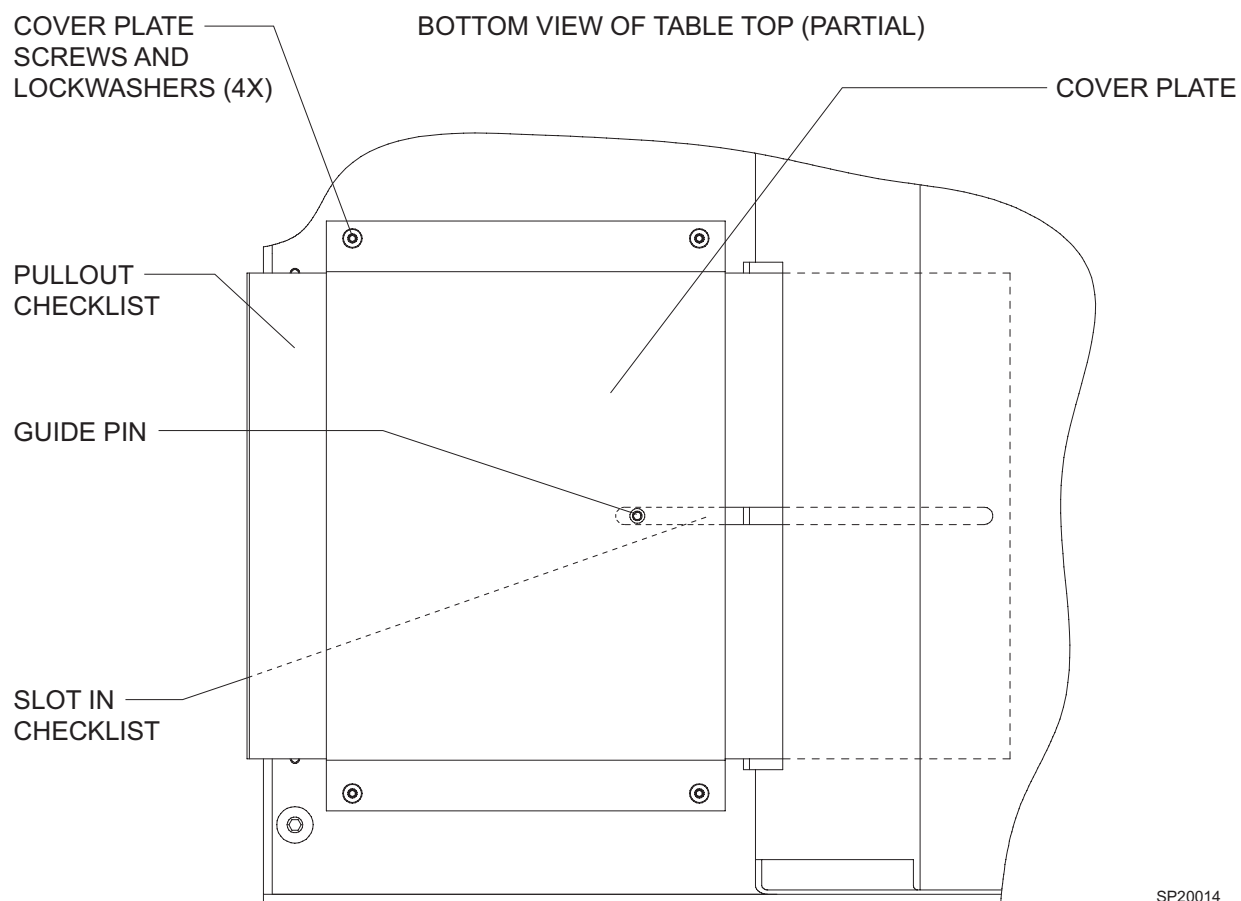


FIGURE 14. Pullout Checklist Assembly

Upgrade Procedure (continued)

103. Reinstall the flowmeter housing cover with the hardware that was previously removed.
104. Install the new ventilator box cover with handle (P/N 4114008), using the hardware that was previously removed.
105. Reinstall the writing tray.

Ultrasonic Flow Sensor Installation:

106. Install the ultrasonic flow sensor bracket, clamp and hardware (P/N 4114889, 4114888, HW01103 and HW65000x2) on the expiratory mount of the absorber dome as shown in Figure 15.
107. Install the ultrasonic flow sensor on the bracket.
108. Connect the patient pressure line (P/N 4119368) between the absorber and the quick connect fitting on the back of the VPO monitor as shown in Figure 16.
109. Plug the original O2 sensor cord into the back of the VPO monitor as shown in Figure 16.
110. Install the ultrasonic flow sensor connector hose (P/N 4114912) on the flow sensor and expiratory valve 22 mm port. See Figure 15.

**Power Supply Replacement:
(if applicable)**

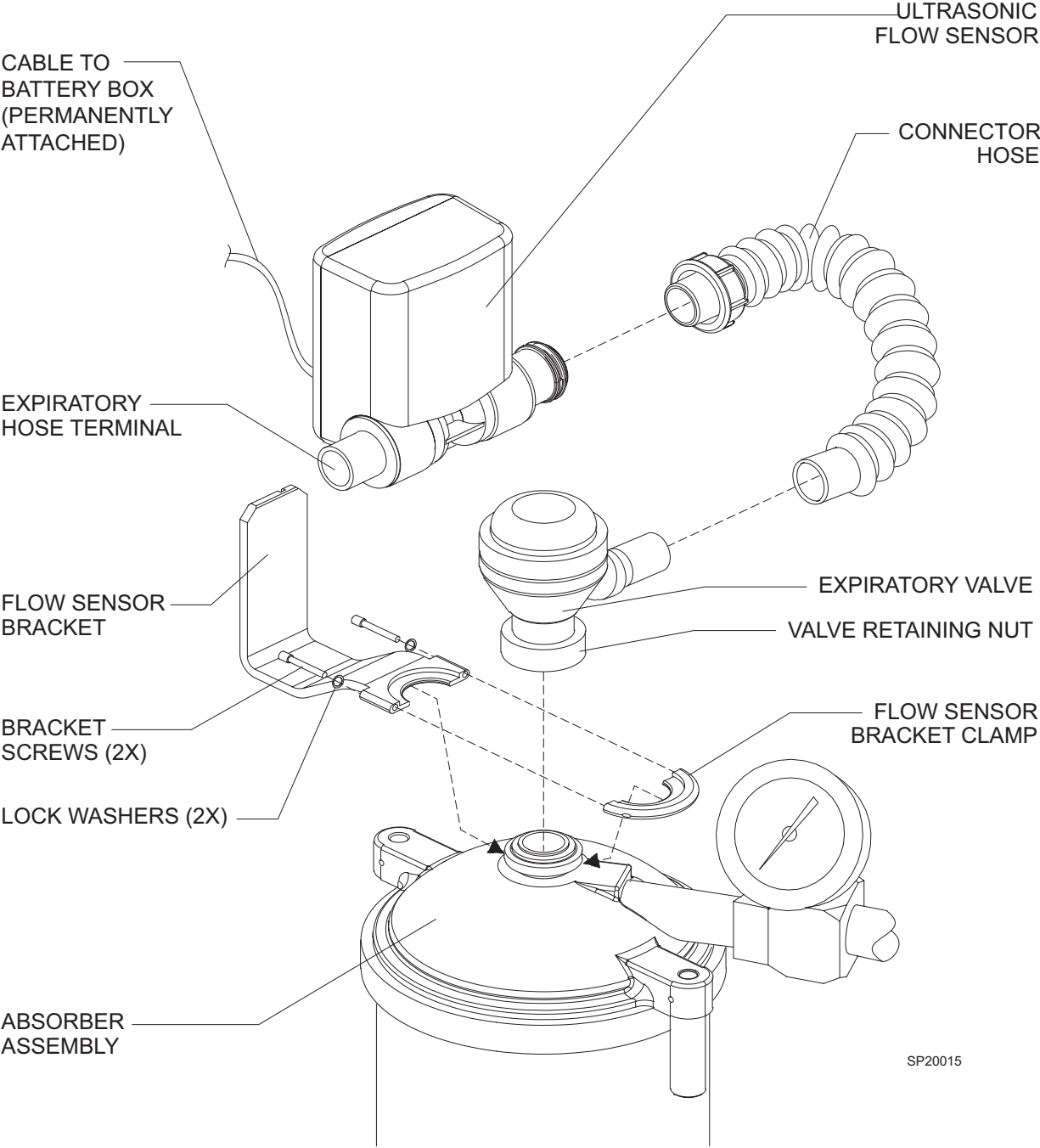
NOTE: If the original machine configuration has an early type power supply as shown in Figure 17, you will need to replace it with the new power supply (P/N 4116068) provided in the upgrade kit.

If the power supply does not need to be replaced, the new power supply must be returned with the original parts removed.

NOTE: The new power supply does not require an external earth ground.

111. Contact the appropriate hospital personnel regarding mounting of the new power supply.
112. Install the new power supply, and connect the DC cable to the machine.

Upgrade Procedure (continued)



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FIGURE 15. Ultrasonic Flow Sensor Installation

Upgrade Procedure (continued)

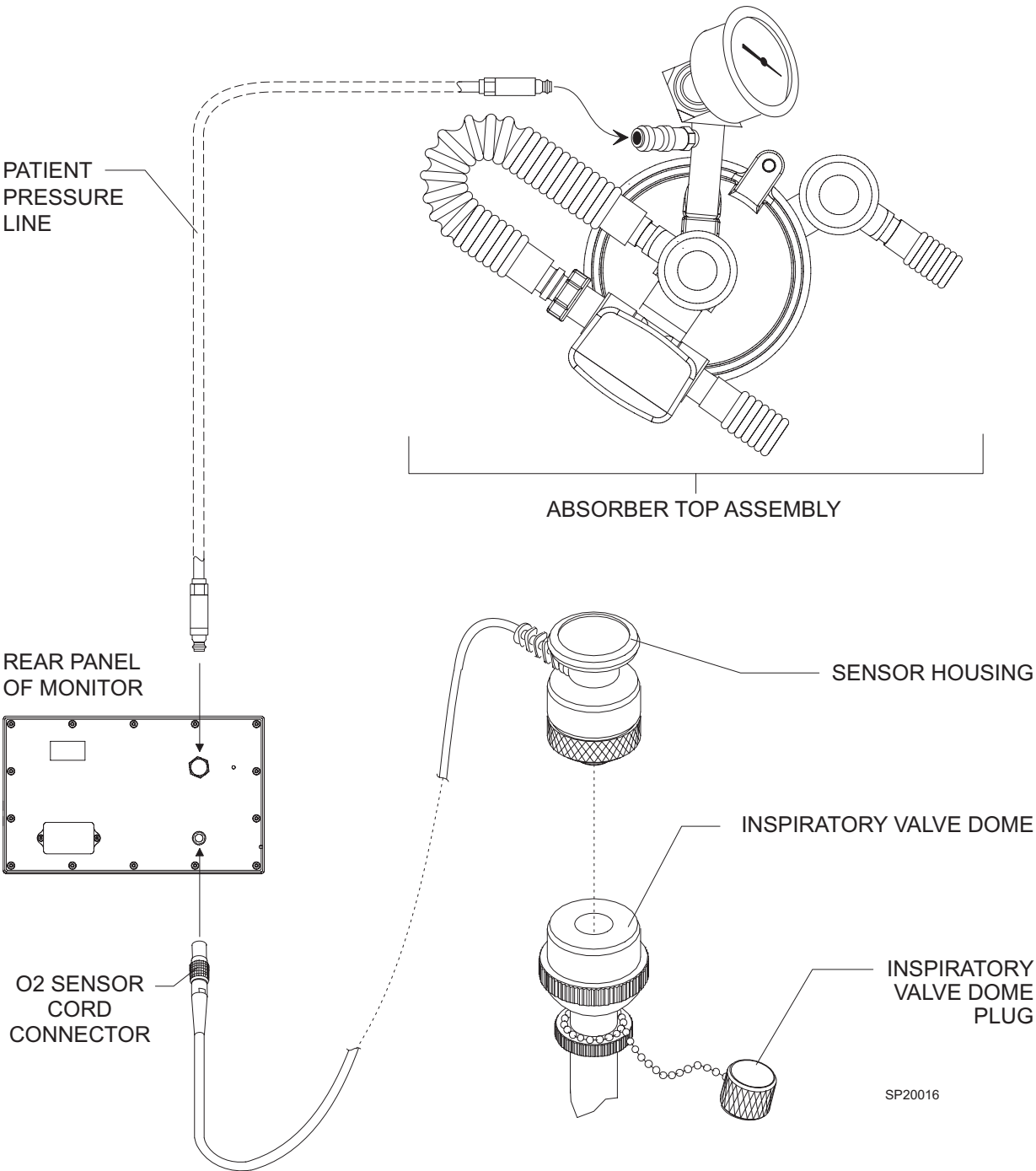


FIGURE 16. Patient Pressure and O2 Sensor Connections

Upgrade Procedure (continued)

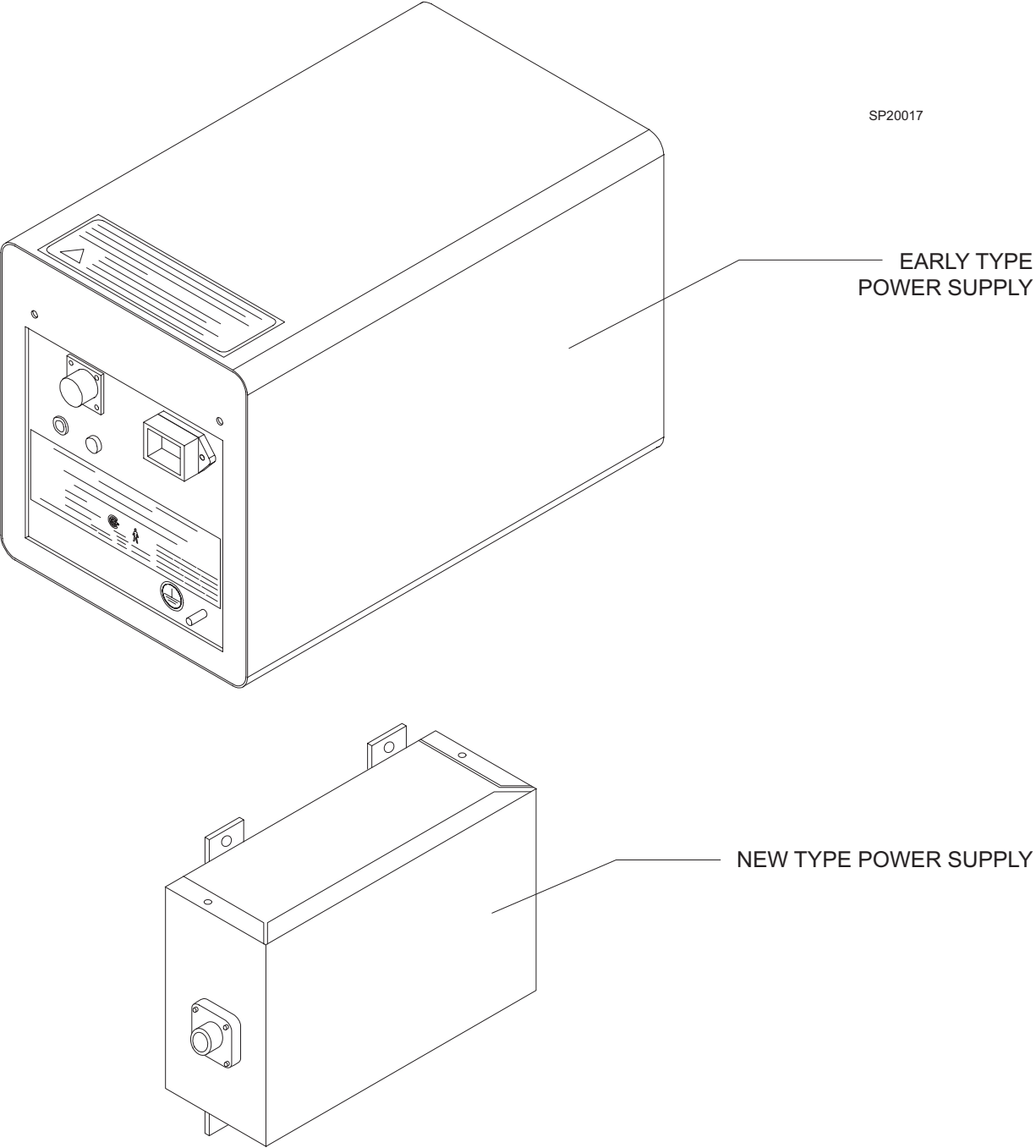


FIGURE 17. Power Supply Identification

Upgrade Procedure (continued)

Final:

113. Locate the customer's binder and instruction manual assembly for this machine. Replace it with the new binder and instruction manual assembly (P/N 4113942).
 - Contact your Customer Service Representative to obtain an RMA Number for part number **4113132-004**.
 - Complete the supplied FedEx airway bill. See Figure 19.
 - Contact FedEx at 1-800-463-3339 to schedule a pick-up for the container.
 114. Carefully package the removed parts in the reusable container as shown in Figure 18:
 - Pack the old vent box and bezel in Box #3 using the shipping pieces that accompanied the new parts. Tape the bag closed, and tape the box closed.
 - Pack the old battery box with cover, and the old binder in Box #2 using the shipping pieces that accompanied the new parts. Tape the bag closed, and tape the box closed.
 - Place Boxes #2 and #3 into Box #1.
 - Pack the Core-M monitor in Box #5 with bubble wrap, and use the foam caps that came with the VPO monitor. Tape the box closed.
 - Pack the original power supply (if applicable) in Box #4.
 115. Perform a complete PMS procedure on the machine per Section 6 of the NM MRI Service Manual.
 116. Perform an Imaging Test Protocol (ITP) in accordance with SP00196 and forward the documentation to DrägerService.
FAX No.: (215) 721-5784
 117. Return the machine to its original clinical configuration and position.
- NOTE: If the existing power supply did not need to be replaced, return the one that was provided in the upgrade kit. Pack it in box #4.
- Also pack any miscellaneous parts being returned in Box #4 and tape the box closed.
 - Place Boxes #4 and #5 into Box #1.
 - Place the old ventilator box cover in Box #1 as illustrated, and tape the box closed.

Upgrade Procedure (continued)

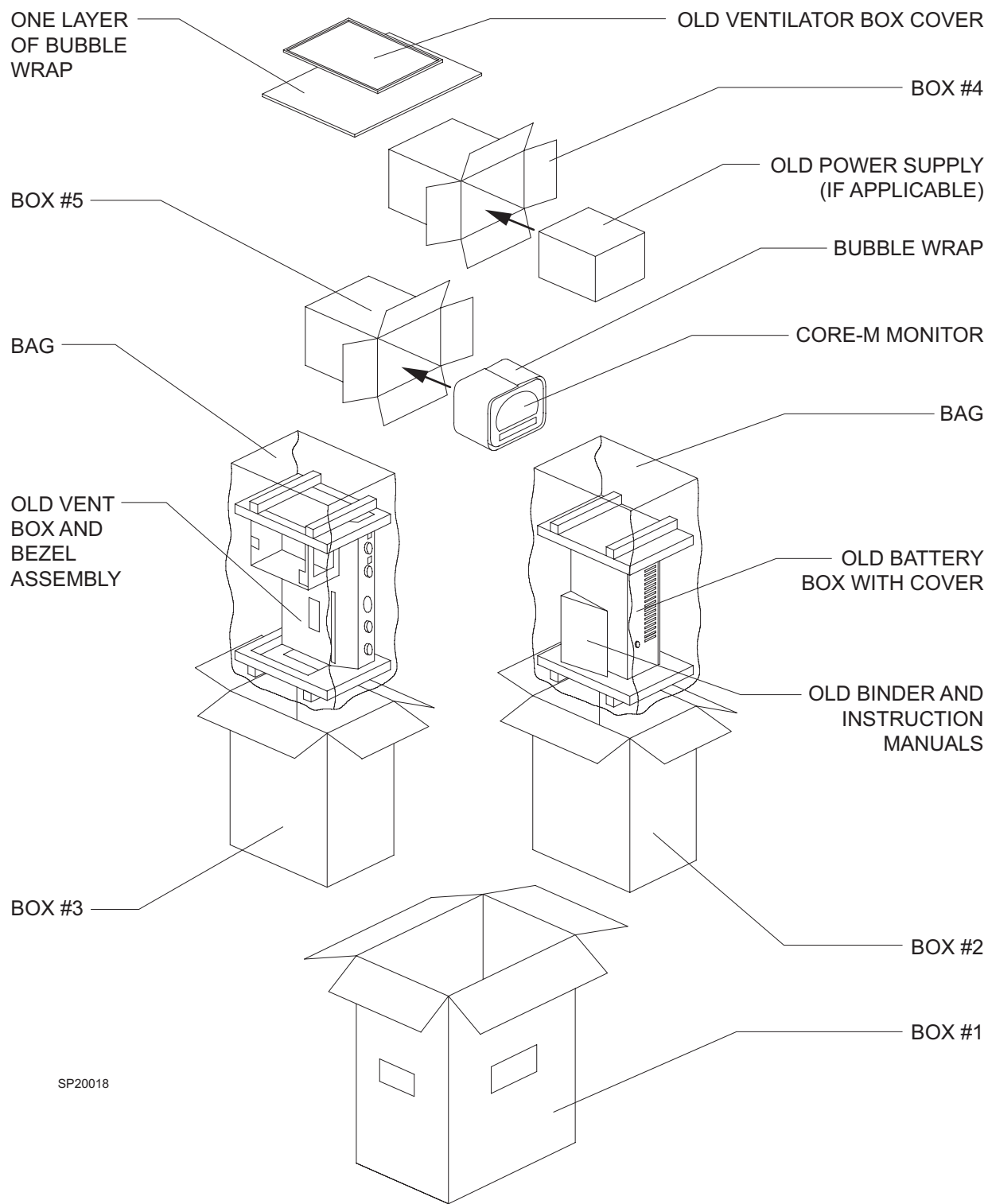


FIGURE 18. Packaging for Return Items

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